International Journal of Botany Studies
www.botanyjournals.com
ISSN: 2455-541X
Received: 04-08-2024, Accepted: 03-09-2024, Published: 18-09-2024
Volume 9, Issue 9, 2024, Page No. 39-41

Antibacterial potential of leaves of some *Ficus sps.*

Sharad Bissa
Department of Botany, Microbiology and Plant Pathology Laboratory, Jai Narain Vyas University, Jodhpur, Rajasthan, India

Abstract
A large population of the world is extensively using plants for their health care and as a method of disease remedies. A serious threat to global public health is the widespread of bacterial resistance to antibiotics. The antimicrobial properties of plants are related to their ability to produce secondary metabolites possessing antimicrobial action. In the present investigation antibacterial activity of leaves of four *Ficus* species viz. *Ficus religiosa*, *Ficus benghalensis*, *Ficus recemosa* and *Ficus benjamina* was tested against some pathogenic bacteria viz. *E. coli*, *Enterobacter aerogenes*, *Streptococcus mutans*, *Staphylococcus aureus*, *Pseudomonas syringae*, *Pseudomonas putida*, *Bacillus subtilis* and *Agrobacterium tumefaciens* procured from IMTECH, Chandigarh. Disc diffusion method was used to determine the antimicrobial activity of different extracts (Aqueous, Ethanol, Chloroform and Petroleum Ether). All the extracts exhibited significant antibacterial activity and highest activity was observed in petroleum ether extract of leaves of *F. racemosa* against *P. syringae* and leaves of *F. religiosa* against *S. aureus*. Similarly chloroform extract of leaves of *F. benjamina* was found highly effective against *E. coli*. No antibacterial activity was observed against *A. tumefaciens*. Phytochemical analysis for all the extract was also done for testing the presence of tannins, saponins, steroids, terpenoids, glycosides, alkaloids, phenols and flavonoids.

Keywords: Disc diffusion, *Ficus religiosa*, inhibition zone, chloroform extract, alkaloids

Introduction

Globally plants are the potential source of phytochemical compounds and traditional medicine (Prusti *et al*, 2008) [1]. In last few decades, due to over usage of allopathic drugs, the pathogens have become resistant to several drugs. This leads the need to study and obtain novel antimicrobial compounds from plants for production of safe, biodegradable drugs with lesser side effects (Rajasekaran *et al*, 2008) [2]. *Ficus religiosa* (L) which is commonly known as "Peepal" belongs to the family Moraceae and is worshipped as a holy tree (Devanesan *et al*, 2018) [3]. This plant has several medicinal properties including antibacterial, antiulcer, antidiabetic and also used in skin diseases (Chandrasekar *et al*, 2010) [4]. According to several studies the plant bark possesses different phytochemical like saponins, tannins, flavonoids, steroids, cardiac glycosides and terpenoids. The Peepal tree is very efficacious in diabetes (Makhija *et al*, 2010) [5].

F. benghalensis is commonly known as Banyan tree or Indian Fig (Pierantoni *et al*, 2018) [6]. This plant has showed various properties, including antimicrobial, antidiabetic, antiinflammatory, antiproliferative, anticancer, hepatoprotective, antistress, antitumor and wound healing (Murugesu *et al*, 2021) [7]. It is used as a traditional dietary supplement for the treatment of peptic ulcers. The latex of this plant is used as a blood purifier in urinary disorders (Gill *et al*, 2016) [8].

Ficus benjamina (L.) is known as sobbing fig. The various parts of *F. benjamina* including bark and leaves possess potential bioactive compounds such as quercetin, cinnamic acid, caffeic acid, lactose, stigmasterol and naringenin which are responsible for therapeutic properties of plant (Mahomoodally *et al*, 2019) [9].

Ficus racemosa is commonly known as Gular or cluster fig. Pingale *et al* (2019) [10] have reported that the fruit of gular *(F. racemosa*) shows antifungal, antibacterial and antimicrobial activity in different extracts [10]. Due to so many medicinal properties of *Ficus* species, this study is an attempt to investigate the antibacterial potential of leaves of above mentioned *Ficus* species.

Materials and methods

Preparation of plant extracts: Leaves of all four *Ficus sps.* were collected from different localities of Jodhpur region of Rajasthan. The leaves were thoroughly washed and then dried under shade at 28±2°C for about 10 days. The dried samples were ground well into a fine powder in a mixer grinder and sieved to give particle size of 50–150mm. The powder was stored in air sealed polythene bags at room temperature before extraction. 25g of dried powder of leaves was packed in a Whatmann filter paper no.1 and was extracted in a soxhlet apparatus using 100ml of solvent. Solvents used for extraction were petroleum ether, chloroform, ethanol and water as solvent and the extracts were dried. The dried extracts were stored in a refrigerator at 4^0C. Finally concentration of 5 mg per disc was loaded on each disc.

Antimicrobial susceptibility test: All the leaves extracts were screened against eight pathogenic bacterial strains. The tested organisms were *E. coli*, *Enterobacter aerogenes*, *Streptococcus mutans*, *Staphylococcus aureus*, *Bacillus subtilis*, *Agrobacterium tumefaciens*, *Pseudomonas putida* and *Pseudomonas syringae* obtained from IMTECH, Chandigarh, India. The Disc Diffusion method (Bauer *et al*, 1966) [11] was used to test the antibacterial activity of the leaves extracts [11].

Phytochemical screening: The leaves extracts were subjected to preliminary phytochemical screening for presence of terpenes, saponins, steroids, glycosides, alkaloids, flavonoids, phenols and tannins (Harborne, 1998) [12].

Results and discussion

Worldwide increasing bacterial resistance is a serious problem and scientist are investigating antimicrobial effects of different extracts against a broad range of bacteria to develop a natural class of antimicrobial agents [13]. In the present investigation petroleum ether extract of leaves of *F. benghalensis* was found to be highly effective against *B. subtilis* and *Pseudomonas syringae*. The phytochemical analysis also showed presence of all tested phytochemicals. According to Khan and Ahmad (2012) [14] ethanolic and methanolic bark extracts of *F. benghalensis* exhibited significant antibacterial activity against several Gram-positive and Gram-negative bacteria [14]. Areef and Ahmed (2022) [15] studied the antibacterial activity of leaves and bark extracts of *F. benghalensis* [15]. Similarly Bissa *et al* (2007) [16] studied the antibacterial potential of *Piper betel* leaves against oral bacteria [16]. In case of *F. religiosa* highest activity was noticed in petroleum ether extract of leaves against *S. aureus* and *P. syringae*. The phytochemicals present in leaves are tannins, saponins, flavonoids, alkaloids, terpenes and phenolic compounds. Nirwana *et al* (2018) [17] studied the antibacterial activity of fig leaves against *Enterococcus faecalis* [17]. Bissa and Bohra (2015) [18] observed antibacterial properties of different plant leaves against human pathogenic *Enterobacter aerogenes* bacteria [18].

In present study the leaves of *F. racemosa* showed highest activity in petroleum ether extract against *P. syringae* and *Bacillus subtilis*. The phyto-constituents present are Flavonoids, Tannins polyphenols, terpenoids and alkaloids. Similarly Dhas *et al* (2021) [19] evaluated the antibacterial potential and phytochemical composition of *F. racemosa* leaf extract [19]. Similarly antibacterial activity of *F. racemosa* bark extracts against pathogenic bacteria Padma and Khosa (2010) [20]. Singh *et al* (2021) [21] examined the antibacterial potential of leaves of some ethno-medicinally important plants against some human pathogenic bacteria [21]. In current study the leaves of *F. benjamina* were highly effective against *E. coli* and *S. mutans* when extracted with chloroform. Similarly petroleum ether extract of leaves was effective against *S. mutans*, *B. subtilis* and *P. putida*. The main phytochemicals present are tannins, alkaloids and phenolic compounds. Similarly Imran *et al* (2014) [22] has done studies on chemical composition and biology of *F. benjamina* [22]. *In vitro* evaluation of antibacterial activity of leaves crude extracts of *Ficus sps* was done by Koona and Rao (2012) [23]. Research on antibacterial activities of leaves of Citrus and different religious plants against harmful bacteria have been done by many researchers, proving to be an alternate source of synthetic medicines [24], [25]. None of the tested *Ficus* leaves extracts were effective against *Agrobacterium tumefaciens*.

Conclusion

In current era bacteria have developed multiple resistance towards antibiotics because of their excessive and improper use, which has stimulated scientist all over the world to search novel natural antimicrobial agents capable of combating resistant bacteria. The present study is an attempt to reveal the antimicrobial potential of leaves of different F*icus sps* using various solvents. Majority of leaves extract were found to be effective against tested bacteria and extraction in petroleum ether solvent showed highest antibacterial activities. Leaves extracts have been broadly used to treat bacterial diseases due to presence of phyto-constituents which are antibacterial in nature. The present investigation provides scientific proof to further determine the bioactive principles and medicinal properties of *Ficus sps*.

Table 1: Antibacterial Activities of *Leaves of Some Ficus sps* against Pathogenic Bacteria

Plant	Plant Extract	Zone of Inhibition (mm)							
		EC	EA	SM	SA	BS	PP	PS	AT
Ficus religiosa	Aqueous	-	4±0.35	5±0.42	-	4±0.23	-	-	-
	Alcoholic	6±1.24	6±0.42	5±0.24	7±0.76	7±0.86	6±0.45	6±0.45	-
	Chloroform	6±1.69	7±1.15	8±0.83	9±1.15	7±0.73	8±0.63	7±0.81	-
	Pet. Ether	5±0.47	7±1.15	9±0.81	**11±0.81**	9±1.23	9±1.15	10±1.15	-
Ficus benghalensis	Aqueous	4±0.56	5±0.24	-	5±0.32	5±0.32	-	4±0.24	-
	Alcoholic	7±1.56	5±0.47	7±0.47	5±0.32	5±0.32	6±0.24	6±0.32	-
	Chloroform	7±0.47	5±0.24	7±0.76	9±1.52	10±1.69	9±0.76	8±0.76	-
	Pet. Ether	8±1.52	6±0.33	7±0.24	8±0.67	11±1.81	9±1.81	10±1.15	-
Ficus racemosa	Aqueous	-	4±0.42	5±0.23	4±0.33	-	5±0.32	5±0.24	-
	Alcoholic	5±0.32	7±0.56	8±1.15	7±0.56	6±0.36	7±0.46	6±0.42	-
	Chloroform	6±0.65	7±0.37	6±0.38	8±1.15	9±0.75	9±0.73	10±1.52	-
	Pet. Ether	6±1.15	8±1.15	8±1.24	10±1.73	11±1.15	10±1.32	**12±0.47**	-
Ficus benjamina	Aqueous	5±0.24	-	6±0.32	-	4±0.23	5±0.24	-	-
	Alcoholic	6±0.34	6±0.81	7±0.67	-	7±0.24	6±0.24	7±0.76	-
	Chloroform	**11±0.47**	9±1.52	10±1.73	9±1.15	9±1.86	9±0.81	9±1.15	-
	Pet. Ether	8±1.15	9±1.24	10±1.52	9±1.23	10±1.15	10±1.52	9±0.81	-

EC: *E. coli*, EA: *Enterobacter aerogenes*, SM: *Streptococcus mutans*, SA: *Staphylococcus aureus*, BS: *Bacillus subtilis*, PP: *Pseudomonas putida*, PS: *Pseudomonas syringae* and AT: *Agrobacterium tumefaciens*

Table 2: Phytochemical Analysis of *Leaves of Some Ficus sps*

Phytochemical Component	*Ficus benghalensis*	*Ficus religiosa*	*Ficus racemosa*	*Ficus benjamina*
Alkaloids	+	+	+	+
Glycosides	+	-	+	-
Saponins	+	+	+	+
Flavonoids	+	+	+	+

Tannins	+	+	+	+
Phenols	+	+	+	+
Terpenoids	+	+	+	+
Steroids	+	+	-	-

References

1. Prusti A, Mishra SR, Sahoo S, Mishra SK. Antibacterial activity of Some Indian Medicinal plants. Ethnobotanical Leaflets,2008:12:227-230.
2. Rajasekaran C, Meignanam E, Vijayakumar V, Kalaivani T, Ramya S, Premkumar N, *et al*. Investigations on Antibacterial activity of Leaf Extracts of *Azadirachta indica* A. (Meliaceae) : A Traditional Medicinal Plant of India. Ethnobotanical Leaflets,2008:12:1213-17.
3. Devanesan EB, Anand AV, Kumar PS, Vinayagamoorthy P, Basavaraju P. Phytochemistry and Pharmacology of *Ficus religiosa*. Systematic Reviews in Pharmacy,2018:9(1):45-48.
4. Chandrasekar SB, Bhanumathy M, Pawar AT, Somasundaram T. Phytopharmacology of *Ficus religiosa*. Pharmacognosy Reviews,2010:4(8):195.
5. Makhija IK, Sharma IP and Khamar D. Phytochemistry and Pharmacological properties of *Ficus religiosa*: an overview. Annals of Biological Research,2010:1(4):171-180.
6. Pierantoni M, Tenne R, Rephael B, Brumfeld V, Van Casteren A, Kupczik K, *et al*. S. Mineral deposits in *Ficus* leaves: Morphologies and locations in relation to function. Plant physiology, 2018: 176: 1751-63.
7. Murugesu S, Selamat J, Perumal. V. Phytochemistry, pharmacological properties and recent applications of *Ficus benghalensis* and *Ficus religiosa*. Plants,2021:10(12):2749.
8. Gill NS, Rashmi A, Anmol K, Manpreet K. Free radical scavenging activity and phytochemical investigation of *Ficus benjamina* fruit. International journal of Universal Pharmacy and Biosciences,2016:5:14-26.
9. Mahomoodally MF, Asif F, Shafaq RRAI. A review of the pharmacological potential and phytochemical profile of weeping Fig-*Ficus benjamina* L. International journal of Chemistry and Biochemical Sciences,2019:16:70-75.
10. Pingale T, Duse P, Ogale S. Antibacterial and antifungal approaches of *Ficus racemosa*. Pharmacognosy Journal,2019:11(2):355-357.
11. Bauer AW, Kirby WMM, Sherris JC, Turck M. Antibiotic susceptibility testing by a standardized single disc method. The American journal of clinical pathology,1966:45(4):493-496.
12. Harborne JB. Textbook of Phytochemical Methods: A guide to Modern Techniques of Plant Analysis (5th Edition), Chapman and Hall Ltd, London, 1998, 21-72.
13. Bakri IM, Douglas CWI. Inhibitory effect of garlic extract on oral bacteria, Arch Oral Biol, 50, 645-651.
14. Khan S, Ahmad SMV. Antibacterial activity of bark extracts of *Ficus benghalensis* against clinical isolates of bacterial pathogens. Asian Pacific Journal of Tropical Biomedicine,2012:2(2):973-978.
15. Areef KM, Ahmed MM. Antibacterial activity of different leaves and bark extracts of *F. bengalensis*. J. Res. In Medical and Dental Sciences,2022:10(1):242-255.
16. Bissa S, Songara D, Bohra A. Traditions in oral hygiene: Chewing of betel (*Piper betel*) leaves. Current Science,2007:92(1):26-28.
17. Nirwana I, Rianti D, Soekartono RH, Listyrini RD, Basuki P. Antibacterial activity of Fig Leaf (*Ficus carica*) extract against *Enterococcus faecalis* and its cytotoxic effect on fibroblast cells. Veterinary World,2018:11:342-347.
18. Bissa S, Bohra, A. Antimicrobial Botanicals against *Enterobacter aerogenes*. Advances in Plant Sciences,2015:28(2):269-273.
19. Dhas MS, Patil MK, Awandkar SP, Deshmukh AA, Khan MA. Antibacterial potential and phytochemical evaluation of *F. racemosa* leaf extract. The Pharma Innovation,2021:10(9):5-9.
20. Padma, NP, Khosa, KS. Antibacterial properties of *Ficus racemosa* bark against Gram-positive and Gram-negative bacteria. Journal of Ethnopharmacology,2010:128(1):14-18.
21. Singh N, Chhangani N, Bissa S. Studies on antibacterial activities of two ethnomedicinally important plants. International Journal of Botany Studies,2021:6(6):1567-1570.
22. Imran M, Rasool N, Rizwan K, Zubair M, Riaz M, Haq M, *et al*. Chemical composition and biological studies of *F. benjamina*. Chemistry Central Journal,2014:8(12):1-10.
23. Koona SJ, Rao BS. *In vitro* evaluation of antibacterial activity of crude extracts of F. benghalensis, Banyan Tree leaves. Indian Journal of Natural Products and Resources,2014:3(2):281-284.
24. Bissa S, Bohra S. Screening of antimicrobial properties of *Citrus limon* (L.) against some pathogenic bacteria. Bulletin of environment, pharmacology and life sciences,2022:11(2):85-89
25. Bissa S. Antibacterial activities of some religious plants against pathogenic bacteria. International Journal of Natural and Applied Sciences,2018:5(10):48-55.